

REMARKS

This is in response to the Office Action dated November 16, 2007.
Reconsideration in view of the following is respectfully requested.

The claims stand rejected as being obvious over OOSEDO. The composition described in OOSEDO corresponds to a resin mixture of (A), (B), and (C) (i.e. matrix resin), of the present invention. Applicant has amended the independent claims to emphasize that the carbon fibers are impregnated with a sizing agent, which sizing agent comprises a vinyl ester resin having substantially no epoxy resin. (see page 18, lines 1-2).

Such a sizing agent for bundling of carbon fiber filaments is not described in OOSEDO. The examiner refers to [0015] of OOSEDO, which states that the fibers are impregnated with the 'aforesaid resin composition', i.e. an epoxy-containing resin. However, in the present claims, the fibers are reinforced with a different type of vinyl ester resin than that used as component (A) of the claims, which is an epoxy-group containing vinyl ester resin. The vinyl ester resin which impregnates the fibers of (D) are contain substantially no epoxy resin. Simply put, OOSEDO does not teach impregnation of fibers with such an epoxy-free vinyl ester resin. Furthermore, the unexpected advantages of such a novel construction are set forth by applicant in the examples. Accordingly, as OOSEDO does not contemplate incorporating fibers which are impregnated with a substantially epoxy free vinyl ester resin, it can not render the claims obvious.

In the present invention, carbon fibers in a form of strand are impregnated with a sizing agent, before being impregnated with matrix resin. The sizing agent contains a vinyl ester resin (d) as an essential component. The vinyl ester resin (d) contains substantially no epoxy group.

The combination of the sizing agent and the resin mixture of (A), (B), and

(C) (matrix resin) is applied to the present invention. The carbon fiber-reinforced resin composite material obtained in the present invention is superior in physical properties such as bending strength. The reasons are:

i) A vinyl ester resin (d) contained in the sizing agent has high compatibility with the resin mixture (matrix resin) which contains an epoxy group-containing vinyl ester resin (A). Infiltration of the matrix resin into the carbon fiber strand is superior, because the carbon fibers are coated by the sizing agent. In this manner, contact area between the carbon fiber and the matrix resin increases.

ii) A vinyl ester resin (d) contained in the sizing agent has substantially no epoxy group. No bond is formed between the functional group (for example, -COOH) present on the surface of the carbon fiber and vinyl ester resin (d). The functional group of carbon fiber reacts with an epoxy group contained in the matrix resin. Strong bond is formed between the carbon fiber and the matrix resin by this reaction.

In a composite material produced by pultrusion, peeling tends to occur at the interface between a carbon fiber surface and a matrix resin. On the other hand, peeling does not occur easily in the composite material of the present invention by the above reasons.

It is supported by the data of Example 1 and Comparative Example 1 in the present specification that the composite material for which vinyl ester resin (d) is used as a sizing agent shows high bending strength.

The sizing agent of this invention is not disclosed in OOSEDO. Accordingly, it is not disclosed that physical properties such as bending strength of the composite material is enhanced by the combined use of the sizing agent and the resin mixture of (A), (B), and (C).

The applicants believe the claims are now in condition for allowance, and such favorable action is respectfully requested. If any issues remain, the resolution of which can be advanced through a telephone conference, the Examiner is invited to contact the applicant's attorney at the phone number listed below.

CONDITIONAL PETITION FOR EXTENSION OF TIME

If entry and consideration of the amendments above requires an extension of time, Applicants respectfully requests that this be considered a petition therefor. The Commissioner is authorized to charge any fee(s) due in this connection to Deposit Account No. 14-1263.

ADDITIONAL FEE

Please charge any insufficiency of fees, or credit any excess, to Deposit Account No. 14-1263.

Respectfully submitted,

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By 

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